Abstract

[0047] A semiconductor device having at least one layer of a group III-V semiconductor material epitaxially deposited on a group III-V nucleation layer adjacent to a germanium substrate. By introducing electrical contacts on one or more layers of the semiconductor device, various optoelectronic and microelectronic circuits may be formed on the semiconductor device having similar quality to conventional group III-V substrates at a substantial cost savings. Alternatively, an active germanium device layer having electrical contacts may be introduced to a portion of the germanium substrate to form an optoelectronic integrated circuit or a dual optoelectronic and microelectronic device on a germanium substrate depending on whether the electrical contacts are coupled with electrical contacts on the germanium substrate and epitaxial layers, thereby increase the functionality of the semiconductor devices.